



Section1

Fundamentals of Clinical Nutrition

Clinical nutrition is the study of the relationship between food, the maintenance of health and the prevention of disease. Additionally, it is the science of nutrients and how they are digested, absorbed, transported, metabolized, stored, and eliminated by the body. Also, the study of clinical nutrition focuses on how the environment affects the quality and safety of foods, and what influence these factors have on health and disease.

“The study of nutrition dates back to the 18th century, when the French chemist Lavoisier discovered that there was a relationship between the metabolism of food and the process of breathing. By the early 20th century, scientists had found that diseases -- such as beri-beri, rickets, scurvy, and pellagra -- were associated with certain diets. By 1912, the Polish chemist Casimir Funk had found a substance (vitamin B1) that actually prevented beri-beri, and he named it "vitamine." Later it was found that these diseases were caused by the lack of specific nutrients -- vitamin B1 (thiamine), vitamin D, vitamin C, and vitamin B3 (niacin) respectively.” ¹

Before the discovery of vitamins and minerals, the U.S. Department of Agriculture (USDA) published its first dietary recommendations to the nation in 1894. Soon after that, in 1916, the first food guide, called Food For Young Children was published. Caroline Hunt, a nutritionist and the author, divided food into 5 groups: milk/meat, cereals, vegetables/fruits, fats/fatty foods, and sugars/sugary foods. ²

In 1941, at the urging of President Franklin Roosevelt, a National Nutrition Conference was called to action. At this time, the United States Department of Agriculture (USDA) came up with Recommended Dietary Allowances (RDA's) for Americans to follow. RDA's specified caloric intake as well as essential nutrients. The concept of the “Basic Four” food groups was introduced and continued to be used until the 1970's. Milk, meats, fruits and vegetables, and grain products were determined to be the essential food groups.

With the increased incidence of chronic diseases like stroke and heart disease in the 1970's, the USDA needed to address the roles of unhealthy foods. Consequently, during the late 1970s, the USDA added a fifth category to the Basic Four: fats, sweets and alcoholic beverages, for people to consume in moderation. In 1992 the USDA created the Food Guide Pyramid.



The Dietary Guidelines for Americans has been published jointly every 5 years since 1980 by the Department of Health and Human Services (HHS) and the Department of Agriculture (USDA). The Guidelines provide authoritative advice for people two years and older about how good dietary habits can promote health and reduce risk for major chronic diseases. They serve as the basis for our Federal food and nutrition education programs.³

Nutrients

Nutrients are substances obtained from food that perform one or more biochemical or physiological function in the body. The human body has a need for over fifty different nutrients. There are six general classes of nutrients that are considered necessary in human nutrition; carbohydrates, fats, proteins, vitamins, minerals and water.

Three Major Functions of Nutrients:

Nutrients provide energy for human metabolism. Carbohydrates and fats are the primary sources of energy.

Nutrients are essential for tissue growth and repair. Protein is the major building material for muscles, other soft tissues and enzymes while minerals such as calcium and phosphorus make up the skeletal framework.

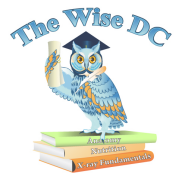
Nutrients help regulate body processes such as metabolism.

Nutrients are categorized as either macronutrients (needed in relatively large amounts) or micronutrients (needed in smaller quantities). The macronutrients are carbohydrates, fats, fiber, proteins, and water. The micronutrients are minerals and vitamins.

The macronutrients (excluding fiber and water) provide structural material (amino acids from which proteins are built, and lipids from which cell membranes and some signaling molecules are built), energy. Some of the structural material can be used to generate energy internally, and in either case it is measured in Joules or kilocalories (often called "Calories"). Carbohydrates and proteins provide 17 kJ approximately (4 kcal) of energy per gram, while fats provide 37 kJ (9 kcal) per gram. Vitamins, minerals, fiber, and water do not provide energy, but are required



for other metabolic reasons. A third class of dietary material is fiber (ie, non-digestible material such as cellulose). An analysis of fiber will be provided later in the text.



The Molecular Composition of Carbohydrates, Fats and Protein

Molecules of carbohydrates and fats consist of carbon, hydrogen, and oxygen atoms. Carbohydrates range from simple monosaccharides (glucose, fructose, galactose) to complex polysaccharides (starch).

Fats are triglycerides, made of assorted fatty acid monomers bound to glycerol. Some fatty acids, but not all, are essential in the diet: they cannot be synthesized in the body.

Protein molecules contain nitrogen atoms in addition to carbon, oxygen, and hydrogen. The fundamental components of protein are nitrogen-containing amino acids, some of which are essential in the sense that humans cannot make them internally. Some of the amino acids are convertible (with the expenditure of energy) to glucose and can be used for energy production just as ordinary glucose. By breaking down existing protein, some glucose can be produced internally; the remaining amino acids are discarded, primarily as urea in urine. This occurs normally only during prolonged starvation.

Most foods contain a mix of some or all of the nutrient classes, together with other substances such as toxins or various sorts. Poor health can be caused by a lack of required nutrients or, in extreme cases, too much of a required nutrient. For example, both salt and water (both absolutely required) will cause illness or even death in too large amounts.⁴

¹ <http://iml.jou.ufl.edu/projects/Fall02/Greene/history.htm>

² <http://iml.jou.ufl.edu/projects/Fall02/Greene/history.htm>

³ <http://www.health.gov/dietaryguidelines/>

⁴ <http://www.answers.com/library/Wikipedia-cid-56389>